

THE BROOKINGS INSTITUTION

HOW MOBILE TECHNOLOGY IS IMPROVING SERVICE DELIVERY

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Welcome and Introduction:

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Former Vice President, Government Affairs
Qualcomm Incorporated

THE ROLE OF INVENTION:

Moderator:

MICHAEL DUFFY
Deputy Managing Editor
TIME

Panelists:

JOHN VILLASENOR
Professor, Electrical Engineering and Public Policy, UCLA
Nonresident Senior Fellow, The Brookings Institution

JOHN SAUER
Head of Communications
Water for People

CHANGING MODELS OF SERVICE DELIVERY:

Moderator:

DARRELL WEST
Vice President and Director, Governance Studies
Founding Director, Center for Technology Innovation
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Panelists:

ZIA YUSUF
Chief Executive Officer
Streetline, Inc.

STEVEN LIVINGSTON
Professor, Media and Public Affairs
The George Washington University

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Mobile Surveys, Inc.

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P R O C E E D I N G S

MR. WEST: Good morning. I hope everybody survived D.C.'s blizzard of 2013 yesterday. It's great how quickly the city got its act back together. You know, there's no snow out there now, so it's a great testimony to Washington, D.C.

I'm Darrell West, Vice President of Governance Studies and Director of the Center for Technology Innovation at the Brookings Institution, and I'd like to welcome you to this forum on Mobile Technology. We are webcasting this event live, so a warm welcome to our viewers from around the country and around the world. We will be archiving this video, so anybody who wishes to view it after today will have an opportunity to do so through our *Brookings.edu* website. We also welcome any comments or questions that you have. We have set up a Twitter feed at #techcti. That's #techcti. So, if you wish to post any comments during the forum, you are welcome to do so.

By the end of this year it is estimated that there will be more Internet-connected devices in the world than people. Mobile usage is rising rapidly, and wireless applications enable users to exchange information on health care, finance, transportation, education, and many other activities.

Today we're going to be discussing the nature of innovation and some of these new models of service delivery that are emerging in the United States as well as around the world. We will talk about how cities, states, and countries are using mobile technology to deliver services and help people. We will look at what progress has been made and what we can do, moving forward, in order to facilitate continued development. And this event is part of our Mobile Economy Project that looks at the impact of the mobile revolution in many different areas.

We're going to have two sets of experts who will discuss innovation, invention, and the effects of mobile technology; and to help us understand this subject, we're going to start with remarks from Dean Brenner. Dean is Senior Vice President of Government Affairs at Qualcomm Incorporated. In that position, he directs the company's initiatives related to spectrum in telecommunications policy. He represents

the company before the Federal Communications Commission and other agencies. In addition, he's responsible for global spectrum acquisitions and strategy.

So, Dean. Thank you very much.

MR. BRENNER: Good morning. On behalf of Qualcomm, I'd like to start by thanking Darrell and Brookings for researching and fostering discussions on the tremendous impact that mobile technologies are having on people and communities around the world. Qualcomm is very proud to support the Mobile Economy project, and I'm of course personally honored to be a part of today's event and to hear from our distinguished panelists and all of you in the audience.

Now, for those of you who may not be familiar with Qualcomm, we are the world's largest manufacturer of chips for cell phones and other wireless devices. We're also the world's largest licensor of mobile technology, because we license our technology to virtually every company in the world who makes cell phones, tablets, other wireless devices, or infrastructure equipment.

This may be the only event in Washington today where you're not going to be told to turn off your cell phone. (Laughter) In fact, if you have a 3G or a 4G phone - - and I suspect that almost everyone here does -- you're using our technology that we invented at our headquarters in San Diego and that then we shared with our partners who made the phone that's in your pocket.

So, for more than 28 years, when Qualcomm was founded, the invention of mobile technology has been our central focus. Together with our partners, we've helped to enable people all over the world to use wireless devices to improve virtually every facet of life.

Now, today, there are approximately 6.7 billion mobile subscriptions around the world. A subscription means some people could have two devices, and there could be machines that are used by companies that don't relate to a person. So, there are 6.7 billion subscriptions, which is really an astonishing fact if you think about it, because the world's population is only 7.1 billion. So we are actually almost what Darrell

said, with one subscription, one device per person. So, what we like to say at Qualcomm -- and I think it's no exaggeration to say it -- is that mobile is the largest communications platform in the history of the world, which is a gigantic statement.

In particular, there are about 2.3 billion 3G or 4G connections around the world. So, as you're going to hear today and as you just know from living, the potential of mobile broadband to improve people's lives, to empower people across all socioeconomic classes is truly tremendous. Mobile technology is promoting opportunity and economic development all over the world, and that's why over the last year Brookings has done a wide variety of research and very interesting discussions, all led by Darrell, on some of the areas where mobile is having such a profound impact, including microfinance, public safety, education, and health care.

Today, you're going to hear about yet other areas, including the ingenious use of mobile technology to improve parking -- yes, parking -- from our great partner, Streetline, to conduct surveys -- yes, surveys -- from mSurvey.

As you also hear today, invention is crucial to making all this happen. At Qualcomm, we believe that invention in mobile technology can never stop. We invest a huge amount of money in research and development. So, in 2013 we spent \$5 billion on R&D, which is more than 20 percent of our annual revenue. So, 20 cents for every dollar of revenue -- not profit, revenue -- that we receive goes right back into research and development. Why do we do that? We do that, because we understand that making advancements in wireless technology, inventing new technology -- it's not cheap, it's not easy, but it's essential, and it's an engine that's not stopping.

Our commitment to invention led us to commission a global survey on the topic. The Time Invention Poll, which you're going to hear more about today, conducted in cooperation with Qualcomm, asked people in 17 countries around the world about their attitudes and opinions about invention. And the results were truly remarkable. Forty percent of the respondents said that the digital revolution from 1980 through today was the most inventive period worldwide. Seventy-one percent of global consumers said

the cell phone is the most useful invention. Not only is digital technology felt to be an important end product of invention, but it's also seen to have made the invention process itself easier today than ever before. Over 50 percent of the respondents believe that inventions drive economic growth, and this is particularly true in emerging markets where 59 percent of the respondents said invention supports a strong economy. And I think we all know this, as I say, from just living.

Equally impressive, though, were people's perceptions of how important it is to protect the ideas that drive inventions. Globally, the United States is viewed as the globe standard in protecting intellectual property. Forty percent of global consumers said that the United States was the country that does the best job of protecting ideas. Invention is also seen as collaborative. While the inventor remains central, sharing ideas and working collectively is recognized to be positive for invention. At the same time, patents, which are core to Qualcomm's existence, are seen as crucial for the invention process; and, in turn, protection of inventions is encouraging more invention.

Now, this survey confirmed a lot of what we believe here at Qualcomm, but the breadth and depth of the appreciation around the world for the invention process and the importance that consumers place on keeping these inventions going was striking even to us.

Today I hope will give us even more examples and insight into how the combination of ingenuity and the inventive spirit are leading to breakthrough advances in the use of mobile technology here in the United States and around the world in so many different ways.

So, at Qualcomm we foresee great things ahead for the mobile industry - ideas and solutions that are addressing many of our most pressing global challenges, cutting-edge mobile technologies that improve and impact social and economic development on a global scale -- and in tremendous ways. So, I look forward to hearing the rest of today's event, and I hope you all enjoy the day.

Thank you.

MR. WEST: So, while these individuals are getting mic'd up, I want to thank Dean for those opening comments, and it certainly is impressive, those device numbers that he was talking about. I know in my household there are two people -- and we have eight devices between my wife and myself, and it seems like every week there's another option that is appearing.

We're going to move to our first panel, which is going to focus on the role of invention in mobile technology, and the moderator for this session is Michael Duffy, who is the deputy managing editor at *Time* magazine. Michael joined *Time* in 1985 as a Pentagon correspondent. He has covered Congress and the White House and served as Washington bureau chief, nation editor, and executive editor of the magazine. He's written more than 50 *Time* cover stories. He's won the Gerald R. Ford Award for reporting both on the White House and on the defense and national security area. With a team from *Time*, he has shared in the Joan Shorenstein Barone Prize for investigative journalism awarded by the Kennedy School of Government. Along with *Time* managing editor Nancy Gibbs, he is the co-author of two best-selling presidential histories. One is *The President's Club: Inside the World's Most Exclusive Fraternity*, and the second book, *The Preacher and the President: Billy Graham in the White House*. And I also want to point out today is a particularly busy day for Michael. We're really pleased that he took time out of his schedule, because you probably already have heard that *Time* today announced its Person of the Year being Pope Francis. So, we tried to get him for the keynote, but he was a little tied up.

But great choice -- Michael. Thank you.

MR. DUFFY: Good morning. Thanks for the introduction.

He is something of an innovator, so I didn't think about bringing him, but this panel's more about invention, which maybe when we have the reinvention panel we'll bring the pope by.

Thank you very much. My household, 10 people -- sorry, five people, 10 devices and counting it seems. It may go up at Christmas, I'm not quite sure.

No matter who we are, where we're from, we love a good invention myth, and we're taught them from the beginning of our lives whether it's Newton and his apple, Archimedes and his bathwater -- buoyancy displacement or even Philo Farnsworth and his plow going back and forth across the field, which led to the idea for him for television. This is a powerful idea that I think we all grew with, which is how things start; where they come from; what makes us think creatively; is it a spark or is something more collective, and is that changing now? I'm going to ask our two experts here to talk about that in a minute, but first a couple of thoughts of my own.

I do think we're living in a kind of golden age of invention, because for not just years or even decades but centuries there have been limits in terms of education and computation and sharing of ideas across borders. All of those barriers are disappearing and they're disappearing in our lifetimes, and they're disappearing fast. It's fairly recent. It feels to me like it's accelerating. And yet at the core of the process of making things new or making things new again -- reinvention -- it's got to be, at some point, an individual act, and I want to explore that a little bit today with our two experts.

And I hope you guys can talk about that in your opening remarks or anything else you think is more relevant than what I've just laid out, which shouldn't be too hard.

We have two great innovators here today. John Villasenor is a Senior Fellow at Brookings. He specializes in digital technology, public policy, and the law. He's an affiliate at Stanford Center for International Security and Cooperation and is a vice chair of World Economic Forum's Global Agenda Council on Intellectual Property System. He got a DBA and then went on to get a master's and a PhD from Stanford, so he's an underachiever. (Laughter)

Also with us today is John Sauer, who is the communications chief for Water for People, which works to ensure safe, affordable, and sustainable drinking water and sanitation for people around the globe. Though John is with us here today, he has worked for more than 20 years in humanitarian projects from Russia to Uganda. He's a

graduate of Fordham and has a master's in international and intercultural management from the School of International Training in Brattleboro. These guys are much smarter than I am.

So, I'm glad you are going to take the questions and I am going to ask them. But before I do, if you could just talk for a few minutes each, and why don't you start, John -- this John, the immediate John to my right, then you can follow. Is that okay?

Thank you, and welcome.

MR. VILLASENOR: Thank you very much.

So, yeah, I think we are indeed living in an age where there's just a spectacular opportunity for invention. One of the things I'd like to -- I'd really like to say two kind of broad things. One is that despite the incredible complexity of today's devices and systems, there's still a real role for the sole inventor, the individual innovator, and I'll give a very specific example of that. Recently, a venture capital company I do some work for asked me to visit a company founded by a person who's trying to invent a better microphone, and you might think, well, you know, is the microphone market that big? And microphones aren't only the things that singers hold on stage. Microphones are in every tablet and every smart phone. In fact, tablets often have multiple microphones. So, the number of microphones that get sold each year in the world is truly staggering -- hundreds of millions or maybe pushing a billion.

And it turns out that the way most microphones today, including both the microphones probably in your pockets and your phones, use a vibrating diaphragm. Basically, you vocalize, you vibrate the air, the diaphragm vibrates. But this gentlemen thinks you can do it with something called a piezoelectric solution, and he has spent eight years doing nothing else, and he did a PhD at the University of Michigan doing it, and now he's started a startup company to try to commercialize it, and just two months ago he was awarded a U.S. patent for his invention. And, you know, it's too early to know whether his company will succeed, but that to me is a really important example of the role

of the single creative innovator and how we absolutely still need those people and those people can and will continue to change the world.

The other final comment I'll make is that one of the great aspects of inventions and innovation is that they have these incredible downstream consequences that could have been very hard to predict, and Qualcomm is a great example as a great innovator in mobile technology. Just the numbers that you may at one time have known but perhaps have forgotten, back in the 1980s, the mid-1980s, the first car-based mobile phone solutions were offered. They cost about \$2500. That's back in 1985 dollars or 1984 dollars. That's probably significantly more today. So, on inflation-adjusted bases, the cheapest feature phones, non-smart phones, are now about 80 times cheaper than they were back in the 1980s. And mobile phones, which were in some cases criticized in the 1980s as toys for the very wealthy, of course have literally changed the world in every single corner of the planet and have benefitted people, really, from every walk of life and every level of the economic spectrum.

So, those are some of the incredible consequences that perhaps even the original inventors of a lot of the technology behind mobile phones wouldn't have necessarily foreseen, but because of strong intellectual property protections and the incentives that go with them, we collectively have -- or those of us who have been involved in mobile technology and companies like Qualcomm -- have really changed the world.

MR. DUFFY: All right, John, do you want to follow, and then we'll take some questions?

MR. SAUER: Sure. I would sort of say that given the complexity of a lot of the intractable problems that we see out there -- and I think the Person of the Year being Pope Francis, his whole push is to solve global poverty -- I mean, if we look at those kinds of global poverty issues, to really solve those I think the kind of innovations or the kind of inventions that we're going to need to see are going to be things that cross silos. I think we've tried to solve these problems in silos -- you know, we've got the

health community; we've got the agriculture community -- whereas, the reality is, I think, solving those issues is going to take, really, working across those lines to get to the solutions that we need to do. Mobile is certainly helping that. I mean, I can look at an example of our own sector -- and I'm in the water sector, water sanitation sector -- and we were faced with a problem that 30 percent of all the programs that are happening with water and sanitation are failing within two years.

So, what did we need to do? We went and we looked at the need to monitor, and to monitor effectively we went and we looked at mobile, and we created a survey. It's called Akvo FLOW, that survey tool that is on an Android-based phone, and now that's how we do all our monitoring across the world. So, it's also I think integrating with the different technologies that are out there.

For example, I think we're seeing a big push to actually have that type of integration and this collective type of approach happening. You've got efforts such as ASHOGA pushing issues like hybrid-value chain work. You have this great research coming out of Stanford on collected impact and the work that's going on there. Now, these aren't inventions, but I think that we have to think of these things as all interrelated and that if we can somehow spur on invention that's taking into effect the ability, the need for us to work across these silos, across these sectors to actually solve these big intractable problems, I think we'll start to get somewhere a little bit faster.

MR. DUFFY: John Villasenor, can you talk to me a little bit about why mobile may or may not be a particularly versatile platform for -- I mean, take us up about 10,000 feet first, you know, why this might be a particularly versatile platform for invention itself. Just what does it offer that perhaps other breakthrough technologies don't, as you look back? I mean, don't go too far back in history. We need to go to the wheel. But as you think about both its potential and what it offers, just talk to me about why this is different.

MR. VILLASENOR: Well, I think mobile is fascinating is because mobile is an information portal, right? And so all of the -- it really unifies -- 20 or 30 years ago,

we would have thought of wireless communications as one field and computers as a completely different field, right? And it puts all these things together, and then having done that it gives us the entire power of the Internet and all of this. So, we have unified an access through one device some things that 20 years ago would have been three different silos really, and so just because of the wealth of capabilities that you have in these devices, there are that many more opportunities to innovate.

MR. DUFFY: And can you talk also just a second about where its applications for data collection and chewing on that data and analyzing it take us to a different level, because I think, for most of us who really just use it as a device to communicate with our children, we only can glimpse, at this point, where that road is going.

MR. VILLASENOR: Well, I think -- that's a great question -- I think many folks here may have heard of the phrase "Internet of things," which is a term that's sometimes used to really talk about a future where we have already arrived at the beginning of that future where many objects, not just personal communication devices, are equipped with global communications technology -- so, appliances; automobiles; environmental monitoring sensor; a long, long list of things. So, I think mobile five or 10 years from now certainly will still mean smart phones, or whatever smart phones look like in five or 10 years, but it's also going to mean a world that sort of comes alive with lots of devices that are processing data and acquiring information. And that's all aided, of course, by advances in chip technology for acquiring all this information. So, I think there are an enormous number of possibilities there.

MR. DUFFY: In the *Time* Qualcomm poll that we did last month, we asked people from, I think it was, 16 or maybe 17, 19 countries -- I forget the number, it was a lot of countries -- to list the most valuable invention in their lives, and while the cell phone totally smoked the field, there were some other interesting answers I want to share in order to get back to John Sauer, and they differ depending on where you live.

I mean, in rank of order after your device there comes the disposable

diaper, the alarm clock, Velcro, cruise control, and the rice cooker. (Laughter) You probably have all of these devices somewhere in your house, even if you don't know it. And there were some fascinating regional variations between those. Germans feel nearly as strongly about the vital nature of Velcro as people in the United Arab Emirates feel about cruise control. (Laughter)

For more on this, you can go look at the poll. I'm not sure you need to know more. (Laughter) But it's there.

John Sauer, since that was a more practical answer to what sometimes can become a theoretical question, someone who's working in water sanitation, talk to me a little bit about the invention you'd most like to see if you could snap your fingers.

MR. SAUER: I think -- you mention the sensor, John -- I actually think there's been some interesting work done with sensors that could probably be stepped up if sensors were really, really inexpensive, for example. So, one of the things that I remember Unilever had done was they put a sensor in a bar of soap so that they could monitor whether people were washing their hands or not. And of course that didn't work exactly the way they had planned it, because in the developing world families of 10 break the soap in half and then share it amongst different households, et cetera, so the sensors didn't do the job.

Another development that's happening right now is that people are putting sensors on toilet doors to see if people are actually using the toilet.

So, there are some quite interesting things that could be done if these technologies, as they become cheaper -- you know, even with the mobile phone, as the Android phone becomes -- now there's maybe a \$50 Android phone and as it become even cheaper, then this ability to do more regular data collection becomes a lot easier, because then people can have these surveys on their phones and they can actually be doing them on a more consistent basis. So, I think in some cases it's not just the technology that's going to leapfrog, but it's actually the use of the technology, because if we look at the water sanitation sector, not everyone is monitoring as rigorously as some

of us are. And to really address this problem, we do need to be monitoring that rigorously. Otherwise, we don't know what's failing, why it's failing; we can't see what's working and why it's working and try to make better decisions based on that data. So, it's really the use of the technology as well that's really critical.

One other point is I think the reinvention -- if we think of the toilet, for example -- actually an interesting poll in 2007 by the BMJ, formerly the *British Medical Journal* -- 11,000 of their readers said that sanitation had been the greatest invention in the past 166 years, and that beat out antibiotics, for example.

MR. DUFFY: Velcro apparently.

MR. SAUER: And Velcro and cruise control as well. Although I do like my cruise control on my German car. (Laughter) But I think -- but if we then go back to 7.1 billion people on the planet that we heard, 4 billion still don't have access to sanitation. So, we know this is a critical public health thing, but we haven't figured out globally how to address this. So, I think we've got to find ways to get these technologies better used -- and I think there will be innovations, for example, with the toilet that will use less water -- that will be great for areas that can't get connected to the sewers, that use no water, and find ways to kill the pathogens. And actually the Gates Foundation has some very interesting work going on in that area called Reinvent the Toilet. So, there you have it.

MR. DUFFY: I'm going to ask John Villasenor one more question, and then we'll go to yours if there are some. You had worked in (inaudible) jet propulsion in a previous life on earth imaging. This is something most of us growing up in the '60s and '70s could not have imagined. It was a really big deal to have one picture of the earth in 1969. Now, of course, you can punch up any piece of the earth you want every morning, and you can have it fed to yourself if you don't believe -- if you don't want to go back.

We did a story at *Time* a few months ago about how George Clooney and Matt Damon have a private satellite focused on one particular part of the South Sudanese border and they're just watching one bad guy. This would have been -- this is

inconceivable to us even a decade ago. Talk to me a little, if you can, about where the edge of innovation is in that field and what's happening and what are you excited about, even though I know you're a bit more removed than you were before.

MR. VILLASENOR: I think what's, to me, the most interesting thing about satellite imaging these days is, thanks to the Internet, we have these images available to just everybody. And so the ability -- does it crowdsource the analysis. That's what's really new. I mean, the satellite images that we get today aren't dramatically different in character, in general, than what what we got five or 10 years ago, so that's, in some sense, very different from -- the smart phones we have today are dramatically different from the smart phones we had five or 10 years ago. But what we have today, which is very different, is the ability to engage with and interact with this information in this pool manner. So, one of the fascinating aspects of creativity and innovation generally, not just with respect to satellites, but it applies to satellites, is this ability to crowdsource and to collaboratively do things on just incredible scales, to collaborative innovation that can involve not teams of five people but 5,000 people or 500,000 people, and satellite imagery is one way where we've seen some very really interesting uses of the data but one of only many of course.

MR. DUFFY: Okay. I have many more, but I don't want to -- this panel can be crowdsourced itself. (Laughter) And I would be foolish to leave all the analysis in one person's hands, so I'm going to take a risk here and bet that someone wants to ask either of our panelists something. You can address and direct it to either John. Just don't direct it to me.

Yes, sir.

MR. BARNES: Yes, my name is Donald Barnes. I'm from South China University of Technology in Guangzhou, China.

We noticed in the news this week about the water pollution that has taken place in the past in Camp Lejeune, and in the paper yesterday or today about the led in the D.C. water. Do you envision a time when we would have a mobile device

where we could test our water before we drink it?

A MR. SAUER: I'm sure that it's possible. It's a little high tech for the work that we do, which is really around basic service delivery, but there are increasingly very sophisticated water technologies out there. If you go to any of these -- the World Water Forum, for example -- the kind of technology that exists now to analyze what's in water is incredible. However, those technologies remain super expensive. So, to do it on the household level I think would still be -- there's a long time before that's going to happen. What we are trying to find is ways to do basic water quality analysis for much cheaper. So, for example, that's one of the weaknesses that we've identified in our monitoring with mobile phones is that we don't do a good enough job on actually looking at the water quality in all of these points that we've put in place over the years. So, what we're now doing is looking at -- and there's actually a \$5 kit now that you can have that you can test the water, you know, to get basic -- you know, again, not these heavy metals or these types of things that you're talking about but the basic -- make sure that the water is healthy enough to be drinking.

MR. DUFFY: Something about that question has made me thirsty. I don't know what it was.

MR. SAUER: I know. Thank you.

MR. DUFFY: Someone else? In the back.

MS. AUSTRIA: Hello, Pat Austria from the World Bank.

I was wondering, we can all agree that there are so many inventions out there, but are there any problems or challenges with having invention become so rampant, for example, less collaboration or the truly game-changing inventions aren't rising to the surface because there are so many coming out?

MR. SAUER: I think that's a great question. So I think generally rampant invention is a good thing, right? You'd want to have -- in fact, I would argue that it's a necessary thing, right?, in order to have the five or 10 or a hundred incredible inventions. You're probably going to have to have a few thousand that are pretty good

and, you know, a few 10s of thousands that maybe don't matter as much. But I think it creates very real on-the-ground challenges for organizations like National Patent Offices right? So, if you're the USPTO, then you're charged with this incredible incoming flood of patent applications, and it is a very, very difficult job to really understand which one of those -- you know, are there patent protections and which one of them don't. So, I think there are burdens there.

I also say that the market does play a role, not always a perfect role but in general a positive role in helping to select, right? So, people who start -- who invent something and then start a company, and if they really are meeting a market demand, a market need -- you know, the world isn't perfect -- doesn't mean that there's a hundred percent correlation, but there is a correlation. So, I think the market plays a good role in helping to sift out the value of inventions. But rampant invention is a good thing. We certainly don't want to reduce innovation.

MR. BRENNER: Now that we've established that we have it -- because I was going to ask you if it was accelerating -- it was my impression that it was accelerating. Now that we've, I think, established that it is, can you just talk a little bit more, John, about why dig a little deeper into the reasons? I was pretty general at the top about computational and education and regional barriers. But are there other factors that we need to just put on the table here that explain the word "rampant," which I thought was great?

MR. SAUER: I think there's a general -- and folks may disagree, but I think there's a general global move toward entrepreneurship. I think there's a greater appreciation of the value of entrepreneurship in, really, almost every country in the world, and really almost an inevitable consequence of being an entrepreneur is thinking about what can you do that's new and innovative to satisfy market need or perhaps even create a market where there wasn't one and then meet that new market that you've created, which is what happened with personal computers. And I think that leads to increased interest in creating.

MR. DUFFY: It also sounds to me like there is a personal motivation at work here in invention; it's not merely curiosity. There's also an element of this that is just individual ambition.

MR. SAUER: Yes, and I think that -- and I agree, and that's not, of course, new. We've had that -- you know, Thomas Edison was famously -- in fact, in the *Time* magazine article on the Qualcomm *Time* survey, you talked about that quite a bit, and that's always been a key driver, you know, ambition to create something, to create something new.

MR. DUFFY: As well as hard work and trial and error.

MR. SAUER: And lack of sleep. Luck.

MR. DUFFY: As we learned from that article, Thomas Edison didn't sleep very much, right?

MR. SAUER: Right.

MR. DUFFY: That's quite something.

Other questions. Yes, sir, in the -- here.

MR. ALTMAN: Hi, I'm Fred Altman. I'm retired.

One of the big advantages of all the mobile phones is you're able -- or mobile devices -- is you're able to gather tons of data, but to make any of that useful, there needs to be a lot of analysis, and we've gotten to the point with big data, et cetera, in analyzing it, and are -- is the back end, the analysis end, getting as much attention as the front end of the mobile devices themselves?

MR. DUFFY: I think you get that one.

MR. VILLASENOR: Okay. It's a question. Big data is recognized as one of the preeminent challenges of the time. I think it is getting a lot of attention. That said, there's an enormous amount more to do, and I would say that we've seen some great examples already. I mean, for example, I've read that people are able to use, for example, Internet search queries to figure out where there are clusters perhaps of disease outbreaks, right?, which would have been impossible to find out years ago. And

of course the U.S. government has funded and is funding some major initiatives built around big data. But it's an incredibly hard problem.

If you read any of these statistics about the amount of data being created (inaudible) stunning things like every week there's enough data created that you'd have to -- if it was HD TV you would have to watch it for a gazillion years. I mean, it's just -- it's incredible. So, I'm sure that we're leaving a lot on the table in terms of information that were we able to know how to get there and look at it, we'd be able to figure things out. But good people are working on it and that's an opportunity for innovation and invention right there -- is big data analysis.

MR. SAUER: I think -- if I could just in -- I think it is about tracing it back to what is the impact that you're trying to solve in some particular area and then making sure that you're using that data to actually make decisions and improve what you're doing versus just having the data, because I think that's -- you know, that's a big question that we see in the international development space a lot -- is we've got a lot of data on what governments are doing, what money they're spending, but are we taking that a step further and saying, okay, we're trying to reduce a little poverty here, how are we really using that data to help us make decisions whether we're on track or off track in that area and make the necessary improvements to get better?

MR. DUFFY: And John Sauer, what else -- how do we ensure that the rampant innovation that we're talking about here doesn't just run to developed nations and developed nations' problems? So much of what we think about in this realm is about technology and is about, rightly or wrongly, consumer technology; and since we're bombarded by all the new things we can do with all of devices, how do we make sure that the inventive culture extends to problems that most of us don't have, things we take for granted that other people in other places have in rampant scale without so many of these other wonderful assists, technological assists, that we've grown accustomed to? How do we make sure that the policies are designed to foster invention, actually, treat problems that we really don't have but other folks do?

MR. SAUER: I think that would make a great *Time* magazine story actually. (Laughter) No, but the reality is that we do need to look at how those inventions are -- I think it's around -- we have to rethink, actually, how we're doing international development, because it's got to not be about, you know, the infrastructure per se but about facilitating this type of effort to happen. So, I look at our own role at Water for People. You know, 10 years ago all we were doing was putting more holes in the ground in communities. Now we really -- our role is much more around facilitating to build the capacity amongst district governments so that they can spend the money that national governments have and do monitoring, too. And that's a big step change, and I think that's the -- so it's really around that facilitation role. So, how do we do things like support more entrepreneurship development to solve certain challenges that we're doing now with -- what we're doing, for example, with sanitation. We're doing a lot of work to bring new entrepreneurs into the sanitation space where if we weren't doing that, no one else is going to be -- no one else is focusing on that. So it is around, I think, rethinking how we do international development overall, because I think that the way we've done it hasn't gotten the results that we want, and that's about better monitoring to understand that, but it's also then about that role of facilitation, I think, versus doing direct implementation.

MR. DUFFY: Do you have -- I'm sorry, go ahead.

MR. SAUER: Go ahead.

MR. DUFFY: Do you have -- can you talk about maybe one success story where you've actually identified an entrepreneur or at least an area where you think that you've had some success in getting from idea to application.

MR. SAUER: Yes, so, one of the inventions in this space has been this device called the Gulper, which is actually a bilge pump, essentially, for pit latrines, because in a lot of the informal settlement areas you can't get in an exhauster truck or a cesspool truck. You know, they're too big, they don't fit down the narrow alleyways, so we've actually developed this innovation, or this invention, let's say, called the Gulper.

Then entrepreneurs can now take this device and empty someone's pit latrine so that it can continue to be used and it doesn't continue to pollute the environment. So, I think, you know, again, that's very low tech, but it's an important invention. And it's allowed these businesses -- we've got several of these in the few countries that we work in, in Africa, that are quite successful.

MR. DUFFY: And where did it come -- can you talk a little bit more about its providence, how it came about?

MR. SAUER: The Gulper itself?

MR. DUFFY: Bilge pump that you --

MR. SAUER: It's a bilge pump for --

MR. DUFFY: It's a souped-up bilge pump.

MR. SAUER: For poop, yeah. (Laughter)

MR. DUFFY: It's a glamorous topic we're going to stay with as long as we can. (Laughter)

MR. SAUER: Again, a good *Time* magazine article. Something on shit would be nice. (Laughter)

MR. DUFFY: Did it start here --

MR. SAUER: About time.

MR. DUFFY: -- or did it start someplace else?

MR. SAUER: No. It started -- I believe in Tanzania is where it first got its footing. One of my colleagues who I work with, he was at the London School of Economics at the time. I think he started to see this need, that all these pits were fallen. He started to say, okay, how do we -- you know, and he's got a lot of friends that are engineers, so he came up with a bilge pump for this issue. So, it did come locally more, but he's a Brit, but still it was definitely developed to meet a local need.

MR. VILLASENOR: One thing I can add just to the question about stimulating invention globally not just in the developed countries is I think intellectual property systems play a really important role in that, and so I think you're seeing more

and more, in developing countries, a recognition of the need to have, to put in place, and to put into practice strong intellectual property protections. And I think -- when that happens, I think there's a direct correlation between confidence that your invention will in fact be protectable and then the energy invested and the money invested to create inventions, so I think that's all moving in a very positive direction, and that's an important component as well.

MR. SAUER: I don't think the Gulper has a patent, by the way.

(Laughter)

MR. DUFFY: I knew that when we started down this alley, we might end up there, but I thought this panel needs to get down to the weeds of the problems.

Yes, sir.

SPEAKER: Do you ever see resistance from the public service providers (inaudible) other ways of delivering services, and does mobile evidence from mobile users who might be providing sort of feedback on the quality of services? Do you that can play a role in sort of breaking down some of those barriers to entry?

MR. SAUER: So, your first question, no we don't -- in the countries that we're working in, we don't see any resistance; in fact, the public utilities are very excited to work with us on this, because they know that they cannot address this problem themselves. And they're quite good partners, to be honest. And, clearly, we would -- the end goal is we would love it for everyone to have a connection to a sewage, and that's what we're aiming for, but I think the reality is that that's very costly, so we need some other types of solutions. We need perhaps decentralized systems; we need some of this -- we still need these other entrepreneurs to play the role that they're playing. So, no, in that -- we don't see any resistance from the public sector; in fact, they're quite keen partners.

And your second question, I think my answer would be, yes, there definitely is a role to play, and we're already doing that. We are using mobile technology to do surveys and also engaging in customer feedback, which at this point is a little bit

more qualitative, but I think, going forward, there probably will be a need, or it will be valuable to do a bit more of that on a wider scale. So, I think the answer is, yes, the mobile can for sure play a role in that.

MR. DUFFY: Obviously government funding and backing has had a role in some great big inventions in our history.

MR. VILLASENOR: The Internet.

MR. DUFFY: Right, just to pick one.

But it's also true that perhaps the government can get in the way. Can you just give us your take on whether we have the mix right now?

MR. SAUER: I think we're doing a pretty good job. I think, you know, government has played a really incredibly important role and is continuing to do so. I think it's hard to make -- it's hard for anyone, I think, to say do we have the mix right now, because I think the Internet -- the first message was sent -- I believe it's was 1969. I may be wrong about that, but it was about then. Now, if we had a panel like this in 1971 and you said, hey, is the government doing the right things, I wouldn't have been able to say, hey, we got the Internet two years ago. We wouldn't have known yet. So, in some sense the answer to whether we're doing the right things is not going to be obvious for -- we don't know, really. But all indications are that that this country continues to enjoy a very healthy mix of government funding for research that then creates, in many cases, innovations and sometimes specific patentable inventions, and of course a robust private sector with venture capital investments and investments made by companies like Qualcomm reinvesting their revenues into inventive activities and so on. So, I think the mix -- you can always tune it a little bit, but it's -- in general, I think it's working quite well.

MR. DUFFY: You opened the door there, John, sorry. If you had the dial on your dashboard and you could turn one up one thing or one or two things there, what would you turn up or turn down? You can go anyway you want.

MR. SAUER: No, I think -- you know, the system isn't fundamentally broken. I do worry -- since you brought it up, I do worry -- there is a growing, in some

sense, anti-intellectual property climate among some quarters, and I worry that the pendulum can swing too far against intellectual property rights, and if that gets reflected in well-intentioned legislation, that could then impede innovation, that that could be a concern as well. So, that climate is out there, and I sometimes worry that the balance could be changed.

MR. DUFFY: Okay --

MR. SAUER: You asked before about how can we get some of these inventions to shift into developing countries where the problem is, and I think that the role of government in that -- and it kind of piggybacks on the other gentleman's question -- is really important, and I think that's another area that we could try to perhaps advocate or shift or support by getting the governments -- I mean, yes, they have the regulatory role to play, but on the other hand playing a more active role, not in doing the invention themselves but actually supporting, providing good market intelligence or supporting -- providing incentives so that the private sector can do research and development in those countries I think would be a really good role for the government to play and one that's been advocated by WSP, actually, which is the Water Sanitation Program at the World Bank in a recent report on innovation and needs in the center. So, I think what the roles are is important, and that would help do as you said, get this moving.

MR. VILLASENOR: If I could just add to that, I think in some of these developing countries, just because, for example, the number of patent filings may not be as high doesn't mean there's not incredible innovation and invention going on or doing a project through the World Economic Forum related to informal IP in the informal economy, and actually this one's focused on India, so of course people in India aren't any less creative or inventive than people anywhere else, and just because they might not be represented with issued patents or trademarks and things like that, there's still just an incredible amount of innovation in all these places. So, the question's really not not getting it to happen but it's really sort of harnessing it and making sure it's properly incentivized and captured and valued.

MR. DUFFY: Okay, we're nearly out of time, and I do get the last question unless this doesn't take up the time, but this is for me particularly a day of summing up at the year as best I'm able and doing so arbitrarily. I'm going to ask both of my colleague panelists a question I didn't prepare them for, and I'm going to ask them in a minute to think up what they think the most important invention or application or innovation is that they have seen this year in whatever field they want to pick, and it can be theoretical or practical. I'll just give you a few more minutes to think about that while I talk for about -- I just think I need to vent for 30 seconds or so, so you can have an answer (laughter), because this is an excellent time (inaudible). There are many gadgets of the year series you can download and best movies and all sorts of things, but I'm hoping that in a panel invention in the middle of December, both of you can just share with us one thing that you didn't have or didn't know about or had, weren't excited about at the beginning of the year that as the year closes you have great hope and prospect for, so.

MR. SAUER: I've got one.

MR. DUFFY: Good

MR. SAUER: One of my colleagues in engineering at UCLA is a professor named Aydogan Ozcan, and what he's done is he has -- and I don't know if that's actually this year, but he's gotten a lot of attention this year -- he's come up with methods to use the imagers, the cameras and cell phones and mobile phones to do medical diagnostic testing, and that's getting incredible traction in the developing world, because you have, you know, these devices that can be used to test for these diseases. And, again, this is one of these "who would have known 20 years ago" that this was out there. So, to me that's an example of just an incredible invention that has the potential to save just innumerable lives and make a real difference using something people already own.

MR. VILLASENOR: Yes, camera phones can do some pretty incredible things, like they can count the number of fecal coliforms in a petri dish now, so you don't

have to count them yourself. You just take the picture, and the camera will count it and tell you, you know, that your water is safe to drink or not.

MR. DUFFY: Is that a this-year development?

MR. VILLASENOR: No, it's not. I just was piggy-backing --

MR. DUFFY: You're dodging me.

MR. VILLASENOR: I did. I did. So, this is something that I just learned about recently, but there's an interesting -- you know, it goes back to this collective decision-making that I think is really critical and important.

There's a software company called Lumio that has developed this kind of collaborative decision-making platform that I just learned about recently and that I think could be very exciting. We haven't used it yet, but I think I'm going to use it for a project I'm working on right now.

MR. DUFFY: How would it exactly go do you think? How would it work?

MR. VILLASENOR: The way that it works is that it just -- you collaborate with a group of people, and we could do this throughout -- will do it with people in Uganda and Denver and the Netherlands, and it helps you just to make decisions about where you're working on programming, on projects. It gives you a way to sort of flag whether, you know, if there's a priority; and then when you want to take a discussion to some kind of actual decision-making piece and create the -- get the team to actually make some decisions around that. So, you can actually do all this virtually without having to have a meeting or send 25 e-mails, and I think it's -- I haven't looked at it too much, but it's quite --

MR. DUFFY: It's a heuristic platform.

MR. VILLASENOR: Yes.

MR. DUFFY: Well, great. We'll need that, I'm sure, the next time we meet. (Laughter) But for now, we have done our best to give you a (speaking in French) of invention in the year 2013 and where we think it's headed. We appreciate your participation. We're going to yield to Panel 2 now. I'm not quite sure how we're going to

yield to Panel 2. (Laughter) Off we go. Thank you.

(Recess)

MR. WEST: So our next panel is going to look at changing models of service delivery. So we're going to look at some specific examples of cool new things that are taking place, but also think more generally about ways to facilitate those types of changes in the future. So we have three leading thinkers in this area. Zia Yusuf is the CEO of Streetline, Inc., a leading global provider of sensor-enabled smart city solutions. He is a seasoned senior technology executive with a track record of leading companies to success. Prior to his role leading Streetline, he was entrepreneur in resident at Sutter Hill Ventures and also Norwest Venture Partners. He spent the last 10 years at SAP AG, where he was executive vice president, and a member of SAP'S executive leadership team.

Kenfield Griffith is the CEO of Mobile Surveys, Inc. M Survey represents mobile surveys that operate in Africa, the Caribbean, as well as the United States. He has a background in computer science, architecture, and engineering. He was educated at MIT, and he has assisted with the engineering and design of M Survey's technology. He discovered that in many emerging markets, they are somewhat constrained by the lack of access to information, and so this approach is something that enables the use of better information in the decision-making process.

Steven Livingston is professor of media and public affairs and international affairs with appointments in the school of media and public affairs in the Elliott School of International Affairs at George Washington University. His research focuses on media and information technology, as well as global politics. He's particularly interested in the role of information technology in governance and economic development. He is the co-editor with Gregor Walter-Drop of a new Oxford University Press book, entitled *Bits and Atoms, Information and Communications Technology in Areas of Limited Statehood*. And it looks at how mobile telephony and digital platforms enable community groups in NGO's to provide public goods in the developing world.

So I'm going to start with Zia. So Streetline uses sensors to enable various types of smart city solutions. I know one of your goals is to improve parking. Welcome to Washington D.C. We could use that solution here. How can mobile help people with parking problems?

MR. YUSUF: So has anybody ever had trouble finding a parking spot? So you are all potential customers. First of all, thanks for having me. It's great to be here. I just flew in on the red-eye from San Francisco, and thought because of the snow I'd never get here. And this seems to be this window of opportunity, so glad to be here.

So, yeah, so Streetline is, believe it or not, in the business of parking. It's an industry that hasn't really changed in the last 30, 40 years. You still have coin operated meters. In D.C. now you have kind of mobile payments and so on. But you search for a parking spot in all of these things. And we looked at this problem from a number of different angles, one from the perspective of a city. Parking is a massive real estate asset in a city in Miami. It's not priced appropriately. It's not allocated appropriately. So we go out and put out these sensors in the ground. The sensors detect the presence of a car. All that data and information then goes to city officials for them to do things like dynamic pricing, to be able to manage those spaces. And think about it in a much more strategic way. In the previous panel they talked about the internet of things and sensors. So that's one piece. In addition, that information, very importantly, also goes to consumers. So we're able to tell you exactly where the open parking spots are on your smart phone, eventually, actually pretty quickly in car navigation as well.

And so what would the mobile panel be without a demo here. I'm just going to show you Boston. We just announced Boston yesterday. So in this part of Boston, at this very second, there's 51 parking spaces that's around the convention center. And this is all on street. And if you click that open, it shows you where the number of spaces are. So this is happening this very second in Boston. I can show you Birmingham. I can show you parts of New York, Fort Lauderdale, and so on. What we're

trying to impact is that decision point, when you get to an intersection. All right, you get to that intersection, do you take a left, do you take a right, do you go straight? You're arguing with your spouse, you know, where do you want to go? So we help marriages as well. And so what we'll be able to tell you is, look, don't take a right. There's less than two spots there. You may find something, but highly unlikely. Take a left where there's either two plus or four plus. You're guaranteed to find parking.

Up to 30 percent of the traffic in the city is caused by people looking for parking, believe it or not. It's a massive drain on the resources of a country. Historically, everybody is focusing on traffic. It takes you 14.2 minutes to get from point A to point B. And there will be a lot of PhD's working on this, and they'll get it down to a precise 13.9 seconds. The problem is, point B is not your destination. If your destination was the Brookings Institute, and you kind of drove by here. You're like, hey, I'm here. It's at 14.2 minutes. Your real destination is point C, when you've parked the car. And it's that second piece of the puzzle that nobody focused in on. So at the end of the day, this is all about, you know, you can talk about new data, you can talk about big data. It's about generating new types of information that wasn't possible before, in this instance through the gates of sensors, and we'll add other sensing devices as we go along. In this kind of silly example of parking, which, you know, when I started doing this, going and having a cocktail conversation and saying, I'm in the parking industry. That was a great conversation. It was like, do you park cars? Do you valet? But it's very sophisticated technology, and it's changing how cities will be run because everybody's realized it has such a massive impact on -- it's usually the second or third largest source of revenue for a city, which most people don't realize.

So that's what we do. And you couldn't do it without the mobile piece of it. All right, whether it's a smart phone, whether it's the in-car piece, or whether it's a google map, whether you make a restaurant reservation with open table, and then you can eventually go reserve a spot in garages as well. So it's kind of connecting those pieces, and it's the mobile technology piece of it that actually gets all that information.

MR. WEST: Interesting, I know in D.C. before they moved to this mobile payment system, which has been great, you literally used to have to carry around bags of quarters. Because you point out, it's a major source of revenue, so of course they were raising the rates, but yet they still were using parking meters. And so that just kind of illustrates the nature of the problem. So Kenfield, you work on a different aspect. You've noted that in emerging markets in the developing world, that countries often lack mechanisms to provide feedback and help decision makers take advantage of available information. So you've developed what you call the survey monkey for emerging markets. How are you using information to improve decision-making?

MR. GRIFFITH: Thanks for having me again. This happened to me when I was doing my PhD at MIT, when I was actually walking around these low-income areas in Kenya. And even though I look Kenyan, I'm not Kenyan. I'm from the Caribbean. So knocking on someone's door just to ask them a question or three questions, taking up their time was very difficult. And we take it for granted that data is something that is ubiquitous everywhere, but it's not, especially in Kenya, and in the Caribbean where I'm from.

And I'll give you three examples. For instance, in Trinidad and Tobago, they have the telecommunication authority of Trinidad. And Tobago has 20 million U.S. dollars invested in infrastructure in the Caribbean when it comes to mobile. But they don't know with 140 percent mobile penetration, who has access to what. What are they using this access for, and who has internet on their mobile phones? So that's why we found it very interesting for us to use that portal to get data, to see where the points are, where limited access to actually invest the 20 million U.S. dollars.

And I'll give you another example with the HIV/Aids in some high-risk communities in Kenya. Dr. Haber who sits in MGH, she travels back and forth to Kenya a lot, and the problem with that is carbon emissions. Also, it's just a fact of time. She wants to assess high-risk communities and understand exactly what their patterns are over a period of time.

So what we did, they used our technology to assess HIV/Aids patients. Every patient that comes into the hospital, they register on our platform, and every day they get a survey that they time. So if I want to get a survey, I say \$2,100, and I get that survey every day. What changes the pattern of behavior, so now people are reporting what happens during their time. Harvard just recently did a study, saying that the best time for you to get valid data is at the frontline. So don't wait until two weeks later to ask someone, how did I serve you? Ask them right then, when you serve them. So it's best for them to remember when the last time they engaged in sexual activities.

And then the third one is agriculture. In Kenya, specifically, most of our work is in East Africa. We're scaling to West Africa, now in the Caribbean. There are farmers throughout Kenya -- they're milk farmers. They produce about a market value of \$3,500 of milk a year. Brookside Farms, who actually buys that, they have no database on these farmers. They have no connection. So these farmers want to improve their yield, and Brookside wants to actually implement facilities to improve that yield. But they don't know the distribution of these farmers throughout Kenya. So we registered 14,000 farmers for them in three days on our technology. Now they interact with these farmers over time, and you can do the match. 3,500 times 14,000 -- that's a lot of revenue for Brookside Farms. And if they can improve that yield, you're improving the profits of that farmer, as well as the profits of Brookside. So this is how information is used to make decisions that change people's lives in emerging markets.

And it's not -- you know I hear a lot of conversation about big data. I'm talking about little pieces of data. How many cattle do you have? That's enough to perform what's a potential yield of milk. So those are the types of things we do.

MR. WEST: Thank you. So, Steven, your new book looks at how mobile empowers community groups and NGO's to provide public goods in the developing world. And I know you've done lots of work in Africa and India, as well as other places. What does innovation look like in the developing world, as opposed to the developed world?

MR. LIVINGSTON: Well, first of all, Darrell, thank you very much for giving me this opportunity to come and share these ideas with you. It's good to be back at Brookings. I've had the good fortune over the last 10 years or so, to travel to about 40 countries, looking at the impact, sometimes positive, sometimes not, of technologies in Africa, in India, as you said, Iraq, Afghanistan. And one of the things that I'm struck by is the -- it's simply the change in the sense of social relationships, political relationships, and communities, that before were fairly isolated. I think one of the things that we have to do in order to begin to get our heads around, our arms around the enormity of the impact of something as simple as the mobile phone, is to keep in mind that in 2000, approximately 2 percent of Africans had access to telephones, and most of those of course were landline. The last figure that I've seen most recently and paid attention to, is 63 percent of Africans in 2012, now have access to mobile telephony. One of my favorite photos -- in fact, it's on the cover of the book that Darrell mentioned, is of a Masai, standing in the middle of the Savannah, holding very proudly two things, his punga, his machete on the hip, but also right next to it is a mobile phone. And what that empowers is just unimaginable, and so it's important for us to just spend some time thinking about that.

There are some technologies and applications that are unfamiliar to most of us in the north. So when we talk about mobile phones, we also have to think about the fact that mobile telephony is just one element in an integrated constellation of systems. This example here uses something called GIS and GPS, as well, probably as mobile telephony. It's the integration of these systems that's so important for us to understand how they truly impact a farmer living in a rural area in Kenya. So some of the technologies that (inaudible) or enabled cellular telephony to be powerful, we may not have heard of, but they're reported -- Frontline SMS and Rapid SMS are texting aggregation platforms that allow for the mass, either management of text messages coming in from phone users, or the distribution of text messaging going out to users. And this is used all over the place. I'll come to an example that fits very well. You know, we

need to keep in mind, also too, that remote sensing satellite imagery and remote sensing data are a crucial part of this equation. The first high resolution commercial, not government, the commercial remote sensing satellite, called Ikonos, went aloft in 1999, became operational in 2000, it's been joined by a constellation of other remotes and satellites. This is another part of a constellation of technologies that come together to make the mobile telephony so important.

And then when we start to think about some of the key applications -- we can take down many examples -- survey is going to be one of them. But in the global (inaudible) there are others. The Grameen Foundation, community knowledge workers, simply empowers farms who hold cell phones in very remote areas to serve as liaisons in terms of best practices for raising a crop. Another example beyond the community knowledge workers is something called trade at hand. I mean the description fits the purpose. It gives farmers information on the daily commodity price quotes. Imagine that you are a farmer raising coffee somewhere in rural Rwanda. If somebody shows up and asks you to buy your coffee, if you aren't empowered with information as to what the daily price fluctuations are, on that key commodity that needs to feed your family for the entire year, you're likely to be taken advantage of. But if you have that information in your hand, you are empowered to communicate on a more level playing field with that intermediary, with that buyer. You know another technology that is possible because of mobile telephony in Africa and elsewhere, any conversation shouldn't miss this, but the revolutionary effect of something called M-Pesa. M-Pesa is responsible, according to a recent study, of one third of Kenya's gross domestic product last year. What is it? M-Pesa is simply -- pesa means money in Swahili. It means mobile money transfer. When you travel around Kenya, as I know that my colleagues know, you will find M-Pesa signs and stands where, if you don't have currency, you can use your phone to pay for a service, a commodity, health care, education, or simply food stock. If you are a merchant with a small little hut somewhere in a rural village, rather than getting on the matatu, the bus, going to Nairobi, buying stock, bringing it back, you get on your phone, you buy the

stock, use M-Pesa, it's delivered on the next matatu that arrives. You get your stock, you sell it, and the exchange itself is based on M-Pesa.

So these are the ways in which mobile telephony are empowering communities, and this is just the start. There are hundreds and hundreds of examples of this sort of thing that we could list. So, you know, this is some of the things that I've been trying to pay attention to in my books, and in my writing, and travel, and thinking and teaching.

MR. WEST: I like the image of the machete on the one hand and the mobile device on the other.

MR. LIVINGSTON: They're both cutting-edge technologies.

MR. WEST: Just consider me -- I'm your stand-up person. Zia, you mentioned that the sensors represent a big growth area. We're seeing a rise of machine communication, so you're focusing on parking. So I'm curious, when you developed this application, what barriers did you experience, and how did you overcome them?

MR. YUSUF: Well, on the technology side, there's certainly -- our sensors last 4 1/2 to 5 years on two double AA batteries, for example, lithium batteries. The sensing technology is getting better and better, and we're doing some work with Qualcomm on looking at some of that sensing capability. So there's just the physics of sensors, and the economics of sensors you have to kind of get over -- get them out there. But I think our biggest challenge honestly, is not the technology piece, it's the exciting process of selling to municipalities and cities, which can be quite exciting and sometimes --

MR. WEST: Is this exciting in a good way or a bad way?

MR. YUSUF: Exciting in a very respectful way. So it's the business model. It's incredible -- and I spend a lot of time now with mayors and city officials and so on and so forth. But it's incredible how much new technology is available to rethink cities. This whole topic of smart cities across the board, and whether it's in community participation or getting information to that old man or old lady who doesn't have to stand

out in the snow and they know when their bus is coming, and there's a whole range of examples, and I think city leaders -- I think mayors, by the way, the most exciting kind of political role in the country today. If you're a mayor and you're forward looking, you can change how people work and live, which will not happen from the federal government side. So it's that -- how does the purchasing and procurement process for cities in the federal government change in order to take advantage of these massively new technologies. So it's more on that go to market side, if you will, and less so on the technology side. The technology side is getting -- I mean it's just unbelievable the kind of things that are possible now. And this whole topic of the internet of things which is mentioned, is going to be -- and you look at GE, and you look at Cisco and (inaudible), and all these companies. The only way to make an inanimate object smart is to put software in it. I used to work at SAP, as you mentioned. I think Siemens has 28, 30,000 software engineers. SAP probably has 15 or 18. You know, who's the software company? So you're having these -- I think every company, in essence, has become a software company, whether you're selling shoes or vegetables or cars or trains or automobiles. And so this internet of things making sense is smart. It's going to have a much bigger impact on how all of us, again, work and live every day, than even the internet did. And by the way, just one comment. It seems like -- we didn't plan this, but we have East Africa and Kenya in common. I also, on my side, kind of teach at Stanford, in the Stanford Design School, a class called liberation technology, which is looking at the use of mobile technology in cooperation with the (inaudible) for economic development. And it's -- it's kind of the low-tech version of mobile, like M-Pesa, and you don't have smart phones, but the mobile coverage rate, even for (inaudible) phones is very high. And in places like Kibera, which is outside Nairobi, I think it's more than 80 or 90 percent of mobile. It's the democratization of information, which is unbelievable.

MR. WEST: Kenfield, you were, you know we hear a lot about big data. You were mentioning the value of little data in the health care area, in agriculture and elsewhere. Now I know you're interested in using M Survey to provide feedback, so that

we can get better decisions. We also know in a lot of countries around the world, people are not particular interested in getting feedback. So I'm just curious, when you have started to market this in the private sector, in the public sector and elsewhere, how have people responded to it, and in cases where the public sector has adopted it, how has it affected the relationship between people and public officials?

MR. GRIFFITH: That's an interesting question.

MR. WEST: Thank you.

MR. GRIFFITH: So, yes, to begin with, there was an issue with folks having a problem with hearing the truth. And I think now on the public and private sector both, I mean there's a lot of competition coming to emerging markets. And how do you, you know, avoid competition or beat your competition is knowing your customers, and knowing your constituents. I think that also pushes the envelope to getting feedback. And on the public side, I mean because of the economies right now struggling from a financial perspective, and people looking for that impact investment, rather than just, oh, I'm going to provide you donor funds to do X, Y, and Z, they're looking to see exactly, you know, what's the end of that equation? You know, what's coming out of that result. So I think just pushing that envelope, or pushing the agenda of private sector knowing that competition is there. You need to beat the competition in the public sector, knowing that you're not going to get funding if you don't show the impact that you're having with my money. I think that actually helps us a lot. And now it's actually becoming more and more necessary for folks to actually have that data to prove, even just to write a grant. You know, they do a baseline survey to show exactly this is the problem, and I need x amount of dollars to invest in this problem, and this is going to be the result. And we'll do another survey again on MSurvey to show you the result. So now we're capturing them at the beginning of the end of the whole cycle. Obviously, we look at it as a design problem. Anything we look at as, you know, a product to a policy. And now you design a policy without feedback groups. And it's a very iterative process. You're not going to just design policy and say, hey, it's going to work. You need that constant feedback to iterate

and develop something that's sustainable over time. So people are learning that, and it's something that you have to (inaudible) as far as how the data can be useful, and how it can give them a competitive advantage. And I think that's the type of language we've actually starting using to show the value.

MR. WEST: So Steven, you were mentioning the importance of system integration. And we know there's a lot of cool stuff, cool technology, cool applications, and so on. But you are suggesting that integrating this is a challenge so we can actually get the benefits. So I'm curious what you have seen as you've traveled around to these 40 different countries, and what lessons can be learned on the best way to do this.

MR. LIVINGSTON: Thank you. I wouldn't really call it a challenge, as much as a tremendous opportunity. Let me give you an example. Nigeria has had a history of challenging elections. There's a challenge. And the last presidential gubernatorial election was monitored by several platforms that utilized the widespread availability of mobile telepathy, mobile phones. It's some called -- one of them is called Reclaim Nige. And what Reclaim Nige did, was it -- a lot of it has to do with mobilizing communities, various civil society organizations mobilize Nigerians through stickers, through wristbands, to give them a short number, that during the election process, if they saw something that they thought wasn't kosher, if you will, they could text that information in. Some 26,000 times that occurred during this election cycle. And a colleague of mine and I were able to look at this process of mobile phones used to geo-locate, put these incidents on a map, to verify them in the process. They knew where they were. They had a good story in terms of what the nature of the problem was. All of these are various systems that come together to allow a level of transparency and accountability in an all important election's process that helps give the government a degree of legitimacy, that in the absence of this verification, Good Luck Jonathan may not have the position that he has for being understood as a president, as a result of a fair and free election. So this is how technology is being used by communities to empower, not just for service provision, but for the provision of good governance. You can find examples of that all over the

world. And it's really quite inspiring.

MR. WEST: So I'll throw out one last question for the whole panel, any of you who want to jump in I can do so, and then we'll open the floor to questions from the audience. And that concerns policy barriers. So each of you have worked in different places. You're working on different aspects of it, so Zia, you're kind of in the smart city area. Kenfield, you're working on feedback devices, and Steven you're looking at political and economic development. What are the biggest policy barriers to making progress in this area, and are there particular provisions that you think would make a difference in enabling additional progress? Any of you that want to jump in. I could have asked what your favorite invention was earlier.

MR. GRIFFITH: I think the biggest barrier is just understanding it. And I think it's more so people. It's not the technology thing. You know, I think the technology is there. I think the intellect is there behind the technology, but absence of knowing how to utilize the technology and to take advantage of that is a big hurdle, and it's just aligning visions. And aligning interest, I think, is a big issue. I mean, that's -- from my experience, and that's just very limited, so I'll say that's my --

MR. WEST: Well, that's an important part of it, too.

MR. YUSUF: I can maybe take a page out of my kind of venture capital book. There's a line for -- and maybe even celebrating or that's a little much failure. As a public official, whether you're spending on a \$10,000 project or a \$10 billion project -- 10 billion is clearly the (inaudible) -- there's this kind of fear that, oh, my God, I can't get this wrong, which then leads to, in many cases, not all, all this very conservative outlook on what should be done. I think if you allow for more rapid experimentation with smaller amounts of money, so it's not a money thing, I think -- and if you say, okay, I'm going to try five different things, I'm going to spend \$20,000 on these five, and there's a potential that a few of them don't work, but one or two of them could -- I think that would make a big change.

MR. WEST: Steve?

MR. LIVINGSTON: Yes, in my case mostly I'm looking at the role of technology in my profession. I call it an area of limited statehood, a place where the state isn't found -- slums, very rural communities. There is no state service provision. So, in terms of policy impediments, it's the absence of policy, it's the absence of the state. But that leads to another problem. It's most often the case you've got more than one NGO trying to fill that governance vacuum, and there's a lack of coordination amongst the NGOs. You end up having a lot of replication of effort.

I'm sure that mSurvey is terrific with its work with farmers, and I applaud that. I think the innovation is going to be great. But there's something else in Nairobi called mFarm that does the same thing. So, I would love to see a day when mSurvey and mFarm compare platforms, come up with a common design, and work together to enlist even more farmers to facilitate even more strength within that sector.

So, here the policy has to do with coordination amongst non-state actors.

MR. WEST: Okay, let's open the floor to questions from the audience. We have somebody with a microphone back there. Just give us your name and your organization. And don't everyone speak at once.

Here's a question. We have a microphone coming up to you.

MR. ALTMAN: Hi. Fred Altman again.

A couple of days ago there was a session here -- it was actually across the street, and it was a pretty good session -- on smart cities, and the one thing I heard in terms of the people responsible for setting them up is not to have isolated, well, we'll do this project and over there we'll do another project, but sort of put all the money in a pot and approach the problem universally, like, instead of parking, the overall transportation problem. And I just wonder, as you sell your product, do you put it in the context of an overall court, transportation, or some other overall scheme?

MR. YUSUF: Can I ask you a question? Were these predominantly large companies that were seeing this? Were they large companies or big institutions that made this comment?

MR. ALTMAN: These were mainly government officials.

MR. YUSUF: Okay.

MR. ALTMAN: But, well, it's a metropolitan study, so cities.

MR. YUSUF: So, I unfortunately patently disagree with that. I think it's ridiculous. If you look at the history of these smart city projects, they generally have not resulted in smart cities. They resulted in a lot of diagnosis, a lot of reports, a lot of conferences, that this is what grand smart city should look like. And then there'll be these big projects of 500, 600 million, 10 years and so on. It's too much. It's just way too much. I think the opportunity is to actually take a smaller slice of the pie, smaller, vertical.

So, now we're trying to solve the problem of parking. And we will. Now, while all these other people are talking about changing the world and having kind of nice discussions on it, we're going and doing it. And we chose parking to go do it. In the same way that other technology companies -- the small startups -- are taking a piece of the puzzle and saying, I can solve this today, I'm not going to wait for what policy will change 10 years from now. For me, long term is three months. I mean, I'm on a budget. I'm running out of money. I can't think that far. So, I have to produce something that people will use, that I can sell, that solves a problem today and next year.

Now, having said that, at a certain point in time, those pieces need to come together. But, yes, parking should be with a policy around transportation and freedom of people moving around. So, there are these bigger issues. But if we just focus on these bigger issues, we'll never bloody get anything done. So, I chose to -- and other entrepreneurs that are attacking this (inaudible) problem -- will see that the efforts in the last 20 years to create these kinds of big plans have led to nothing.

But now, also by (inaudible) you to mobile technology, due to the democratization of information, due to the census staff, there are companies out there building smart garbage cans, smart trucks, water pipes, and all of those things. And, yes, there are some disconnected aspects to it. They all come together.

MR. WEST: I was going to follow up on --

MR. YUSUF: I hope that wasn't unambiguous (inaudible). (Laughter)

MR. WEST: Well, I don't know if was unambiguous for him, but I have a follow-up for you.

MR. YUSUF: Sure.

MR. WEST: In terms of the smart cities area, the applications that I've heard that seem to be most promising and a number of cities around the world have adopted have been one in the parking area and then I think someone on the earlier panel mentioned the bus line situation where through a mobile device you can stand on a particular corner and find when your bus is going to arrive there. I'm curious, from your standpoint what are the other promising areas? There's been a lot of hype. Some have worked out, some haven't worked out. What do you think, other than parking and buses?

MR. YUSUF: Sure, absolutely. So, again, my view is that you take a look at specific, what I call vertical-use cases, right? So, bus information, real-time bus information is one; smart parking is one; the smart grid area in electricity management has been another one, which is a broader issue.

We're now people starting to put sensors on garbage cans, okay? So, now, if you kind of think about the microeconomics of this stuff, a garbage truck going around the city, going to garbage cans that are not full, a quarter full, and making that quarter -- that stuff adds up. You put a sensor in a garbage can that tells you, oh, I'm only half full, don't pick me up today, and move on -- those are those micro-level topics that are important.

Pollution sensors at a block level. That starts to give you a sense of the micro climate at a block level. People can do that today.

Sensors in fire hydrants. I don't know if you know, but a lot of time is spent by fire departments actually checking the water pressure in a fire hydrant. There's no reason to do that. A water pressure sensor is not rocket science. Getting that data out is a little bit tricky, but once you lay out a network -- and Qualcomm and Cisco and other people are kind of looking at doing that -- you can get that information out.

So, transportation is becoming a very, very interesting area, broadly speaking.

Then you have things like Uber, which to me also is very much a smart city-type of service. And Uber -- for those of you who don't, you can use your smart phone and you can find a car or taxi. I took an Uber car from the airport this morning. That's completely reinventing our taxi services, and transportation happens where you're not waiting for something to go by. But that data information -- that thing, in this case, is a car; and the car is telling you, "I'm here, I'm available," and you can avail yourself forward.

So, I think it's -- and you can look at health care, you can look at all these other things. There's a range of those that -- you know, delivery of our social services. I mean, the ability to renew your damn license online instead of going in and standing in line for four hours. I mean, technology did that 15 years ago.

So, that's --

MR. LIVINGSTON: Yeah, and in this city I would add bike sharing has been very popular as well.

MR. YUSUF: Bike sharing has been huge. I mean, you've got Citi Bike in New York. The head of transportation, Gabe Klein, who started the Bike Share here, did the same thing in Chicago six months ago. That is a phenomenal innovation. And now with apps you can find where the bike is so you don't have to walk there and see 10 bike stations that are empty. So, you can see what it is. You can pay for it. I mean, that's where -- the smart city will come from the ground up.

MR. WEST: Okay, literally.

Steven, you're going to jump in?

MR. LIVINGSTON: Well, not to plug Uber, but if this explains Uber, it explains if you don't know what cars -- with cars --

MR. YUSUF: You can plug him. I put some money in, so plug --

MR. LIVINGSTON: The cars with the mustaches in the front? Have you

seen those and you've wondered what they are? Those are the Uber taxies. But that's not what I want to talk about.

I'm interested in trying to translate a conversation about smart cities into what -- I actually am involved in a program called smart slums or smart informal communities where you're trying to leverage these mobile distributed technologies for purposes appropriate to people who aren't worrying about a parking place but they're worried about where to find a bathroom or where to get clean water.

Again, there are many examples of this, but one that comes to mind is actually something that came to mind when John was speaking on the first panel. There is, in India, in some of the informal communities or slums in India, a project being pursued by an NGO where the residents have a simple, little, like, ATM card with not a lot of money on it, but they are able to use this card to get water out of a system that has sensors built into it in many different ways in terms of whether it's operating, in terms of the water pressure, in terms of how often it's being used, et cetera. So, building these kinds of technologies into the global south is what I think is really quite fascinating. Why? Because in the global south you don't have an alternative service provider. The state isn't often there to provide that service. It's not understood to be a viable market for corporations, so it's outside of the market solution set. So, you're looking at ways of leveraging technology, taking the efficiencies that you find, and providing services that are otherwise not there.

One other fascinating example I just want to leave with. Google Earth Engine has a project that is based on Android phones where communities in the Amazon, Indian communities in the Amazon, are doing carbon monitoring and tracking illegal logging in the Amazon. And this, again, is very localized, carbon monitoring being done by indigenous communities in the Amazon.

So, the reach of these technologies is terrific with finding parking places, but it goes so much further than that in the global south.

MR. WEST: And some places in Africa I know they're using this

technology to help the endangered animals as well.

MR. LIVINGSTON: That's right.

MR. WEST: Other questions. There's a gentleman right there on the aisle.

MR. BROOKING: Good morning. I'm Emerson Brooking, an intern here at Brookings.

I was curious -- I read very recently that in early 2014 Twitter will be unveiling a skeleton version of their platform that operates entirely by SMS. And I was curious, from your perspective, whether companies like Twitter that are announcing functionalities like this -- are they meeting a demand that exists now or anticipating a demand?

MR. LIVINGSTON: And this is addressed to me.

MR. BROOKING: To you and anyone else who would like to answer.

MR. WEST: Zia?

MR. YUSUF: So, you're asking if they're meeting demand or anticipating a demand by SMS? Is that what you're asking.

MR. WEST: No.

MR. BROOKING: For Twitter.

MR. YUSUF: For Twitter? I mean, yes, I mean --

MR. WEST: Do you think SMS would be a viable niche?

MR. YUSUF: Well, let me -- that's how Twitter started. Twitter started by SMS. I mean, that was --

MR. BROOKING: Right. Just to clarify. I'm curious whether -- you know, there's an increasing use of mobile technologies in the developing world. Is the demand really a very local functionality, or is there an increasing push to be part of the global dialogue?

MR. YUSUF: So, I think -- for me, the difference is between a smart phone and a feature phone, right? Facebook is having the same challenge in India and

other parts of Africa. They cannot push out this fancy Facebook homepage onto a Nokia, you know, if Nokia still exists in the company, the Nokia feature phone, which is one of the most popular phones in the emerging markets.

So, what we're doing and Facebook and others are doing -- they're kind of coming down the technology stack, if you will, and they have to do it for a certain period of time, because the U.S. in Europe is saturated, right? And there's just so much you can -- and it's a tiny piece of the population.

So, the billions of people are not in Europe and the U.S. And over the next 4, 5, 10 years, in order to get to those people, you can't sit there hoping that every one of them is going to have an iPhone and an Android phone. So, you have to figure out how to deliver that type of capability through a feature phone, and the primary way to do that is through an SMS-type messaging system and not an application-based system. So, that's why they're doing it. I mean, it's straightforward math.

MR. GRIFFITH: I mean for me -- I mean, for mSurvey, that's how we delivery our surveys, through SMS.

MR. WEST: Right. Do you use Frontline or --

MR. GRIFFITH: No, this is our --

MR. WEST: Just your own --

MR. GRIFFITH: Native. Native. We connect directly to the telcos, and we have to agree with the telcos. We're scalable across any region.

MR. YUSUF: And the same (inaudible). (inaudible) would not have gone anywhere if they waited for kind of a nice little user interface and buttons and so on. It works.

MR. GRIFFITH: I think it's platform agnostic, in a sense. I mean, SMS is across any platform that you can use. I mean, specifically for us, we know we're looking to get -- no one's going to download a survey app. I mean, that's just --

MR. BROOKING: Right.

MR. GRIFFITH: That's going to never going to happen, right? So, I

mean, you have to meet someone where they are, and SMS is a, you know, "What's App". It's no different from SMS. I mean, "What's App" has over 200 million users, because it's an easily integrated system that you can use. Everyone is very familiar with SMS. So, I think that's -- I mean, that's just meeting everyone, how they used their mobile phones.

MR. LIVINGSTON: All of that's correct, except for I would say by 2018 it's expected that 50 percent of the phones in Africa are going to be Internet-enabled. And when you spend time, as I do, in Nigeria, Kenya, Ghana, and South Africa, you find incredible growth in some of the social media that you'd be familiar with. So, when we speak of what's going to happen there, we have to be very precise when we talk about where we're talking about, right? Rwanda is another place, so that may surprise, so maybe that is really quite remarkable, and it's in the growth of Internet-abled telephony. So, you have to look very specifically.

I know that Facebook -- the last time, not the last time, one of the recent times I was in Nairobi, Facebook put on a big festival in the middle of the the big public park in the middle of Nairobi. Tens of thousands of people were there celebrating. They had their phones. They were dancing. It was a terrific example of the reach of some of the kinds of technologies that you'd be familiar with in places that you'd be surprised perhaps to find.

MR. WEST: Other questions.

MR. LIVINGSTON: John has one.

MR. WEST: Oh, we have a microphone coming up to you.

JOHN: Steven, you talked about the importance of collaboration and trying to avoid duplication. I'm wondering, could you give some examples of where you've seen that actually happen in developing countries or even here in the United States, but I'm kind of more interested in developing countries.

MR. LIVINGSTON: Yes. So, the question has to do with do you see examples of collaboration amongst people who have likeminded interest goals,

objectives, maybe using different skillsets.

Yes. You see it in small ways. I mean, I could look at something called spatial collective, which works in Mathariti. One of the sons in Nairobi is working also with an NGO that has at its purpose abating some of the hate speech that one finds on text messaging platforms, especially leading up to the recent election in Kenya. So, you have these scrappy, smaller NGOs that are coming together and trying to carve out a niche where they're solving really pressing problems.

In my own experience -- and it may be that this is just simply unique to me where I sometimes see less collaboration. More competition is where you get into the bigger boys and girls, where you have the larger NGOs that are all going after the same Gates Foundation, Ford Foundation, other foundation grants. So, any sort of collaboration, it's like competition within a business community. It's like McDonald's and Burger King collaborating. Probably isn't going to happen any time soon, or should it. You know, it's where you have that competition for funding that I see less collaboration.

JOHN: And that was sort of -- my follow-up question was where -- you know, is this an issue, actually, of the funders? Do they need to do something differently to actually spur this collaboration versus this competition? Not that -- I mean, competition's not -- I'm not saying it's a bad thing. Actually, it's a very good thing. But I'm just saying, you know, is there -- who's going to fund these collective impact types of efforts, because you see it starting to happen a little bit domestically, but I haven't -- it's been really hard to see it happen internationally. I think that's really the key of moving things forward and breaking down some of these cycles of failure actually.

MR. LIVINGSTON: I don't have any direct response to that. You know, one of the things I guess indirectly I would say, however, since I'm really such a huge fan of innovation centers that are found all around the world, some of them are sponsored by the Googles and Microsoft of the world, right? But also there are the examples of iHub, again, in Nairobi where you have entrepreneurs, people who are interested in making money, they have an idea, but they also have a wonderfully collaborative spirit of working

together often and solving common problems and coming together on particular projects, sitting in sort of a communal space in an office building on the Ngong Road in Nairobi. Those are the places where you see the kinds of collaboration that I like.

MR. GRIFFITH: I just wanted to comment also. It's just these problems don't only just persist in emerging markets. I mean, like, for instance, in 2011 in the U.K. it cost the U.K. 400 million pounds to do the census. I mean, they're trying to just get rid of it, because they don't know what to do. I mean, you have mobile phones, you have technologies that can actually circumvent that, you know, so I mean -- and that's why we focus on what we do, which is surveys -- I mean, mobile surveys. I mean, there is nothing as far as -- I mean, the technology at the back end is (inaudible), because it does real-time analysis, but it's just surveys that have been around since the 19th century, right? So, I mean, these are problems that persist in developed countries as well, you know, how you can actually reduce costs counting people. And that comes up to the smart city problem, right? So.

MR. WEST: Okay, there's a question on the aisle there.

MS. HALLESTEIN: Yes, hi. Judith Hallestein, Hallestein Associates.

You talked about sensors being put into roads in developing countries or building or infrastructure or water facilities, and I guess my question is that oftentimes you've seen these items put in and then they break and then there's no ability to fix them or the government can't find new ones or there's some other issue, and then the whole technology is not being used. And what do you see -- and that's why I was always leery about that type of -- going in that way if we don't have an answer of how we're going to train people to get them fixed or to buy them or that, so.

MR. YUSUF: So, I mean, that's -- in a prior life I actually was living in D.C. and worked at the World Bank for about six years, and that's one of the broader issues that our programs of any kind, whether it's technology or education or anything else, is the difference between building something first time and having a nice ribbon-cutting ceremony and everybody takes a picture and then six months later you don't have

the capacity and the money to continue it forward.

So, I think that is a program design issue. I think now because of globalization and the transparency of information and transparency of data around pricing and contracts and so on and so forth, there are ways to deal with that. You certainly -- if it's a project that's designed that doesn't allow for an ongoing capability to operate, then it's a badly designed project in the first place. But if you can -- I mean, there are certainly ways to do that.

But as a (inaudible) that's a problem, and (inaudible) little more about this one on international development projects where so many of these things are front-end loaded, and then, you know, teachers get paid for a year, a nice building, and then when you get the money for the second year people are surprised -- oh, where did the teachers go? Well, here (inaudible).

MR. WEST: Right here's a question.

MR. BARNES: Donald Barnes, South China University of Technology.

This all sounds very good but what about the flip side of this? Is there any danger or possibility and the probability of governments or large corporations, through something like this, co-opting this whole field and taking advantage and control in such a way that we are being used rather than utilizing this technology?

MR. YUSUF: Well, you just have to read the *Washington Post* today that I picked up from the airport. They're talking about what the NSA was doing on cookies and browsers and so on and so forth.

Look, anytime you have software in anything, whether it's a device, whether it's on the Internet, it's a door and it's a two-way door. There's no way to stop that. And you can have this continuous arms race of access and privacy and so on and so forth. Personally, I've given up on privacy. I mean it's just -- there's -- I'm concerned about financial privacy, so there's, like, two or three bank accounts that will make sure my few hundred dollars is okay. But other than that, you have no privacy.

One concern I do have on the Internet of things is that hackers getting

into your Facebook password, and so on, is disturbing and socially challenging. But it's not going to necessarily kill anybody. A Google autonomous car that's chugging along down the street and somebody in some country decides to take it over and make a left turn and drive into a building, if it's software it can be done. And so I think there's an issue around the Internet of things and hacking and access that people haven't talked about yet. And it's also -- you know, there have been some incidences of people trying to take over auto pilots on planes. That's another example of that. So, if something is wirelessly connected, it has software in it, there's a little bit of excitement to be had there, and we'll have to kind of figure that out.

MR. DUFFY: Actually, at Brookings -- I think it was last year -- we had a drone contest, and it turns out a lot of the software is open-source software, and so one of the strategies that was used in this contest was to basically take down all the other drones, and they did it successfully.

MR. YUSUF: Then -- but it does -- I mean, it's -- if it's -- say, if somebody's built it, if a human being's built it, another human being can figure out how to unbuild it. That's the premise, right? And you had last week on *60 Minutes* Amazon -- you know, Jeff Bezos -- talk about the Amazon Prime drones that are going to start delivering packages. Actually, if you have drones kind of flying around, first people are going to start shooting at them just for the hell of it. So, you have to solve that. (Laughter) Throwing rocks at them. But then taking control of those drones. So that's -- as software gets into more physical stuff, I think that's going to be an issue that has to be tackled.

MR. DUFFY: So, maybe I'll close with a summary question for the panel just to get your thoughts on innovation. What do you think are the most important things we can do now, either in the United States or in the developing world?

MR. GRIFFITH: I need more time to think.

MR. WEST: Steven?

MR. LIVINGSTON: Sure. I think that one of the things we need to start

thinking about in terms of encouraging the use of technology wisely is to encourage, actually, the educational base, encourage the education of coders who have a good ethical base, they know what it is they're trying to do in terms of solving problems that are appropriate to their home country, to their region where they live. So, encouraging coding for mobile platforms for wherever the case may be. That's where I would want to turn.

MR. GRIFFITH: I think specifically empathy. I mean, I think innovation is out of having empathy for others and specifically in emerging markets, you know, expressing, solving real-life problems that are scalable. I think that's the focus, because there are a lot of problems in emerging markets that a simple fix can actually change, and to focus on that with technology -- and I agree with the intellect as far as coding and access, access to -- technology access to developing skillsets to solve these problems. And, you know, I'm going to plug mSurvey again. It's head of due process. I mean, there's not even allowing people to fail, you know, within the whole context of developing technologies it's definitely important, because even their coding skills, you also have to accept that part of the developing technologies is failure. So, I think that's a necessary step in emerging markets coming from the (inaudible) myself, whereas you're looking just for A's, and instead of okay, failure is good, what did you learn from the failure to move on, so.

MR. WEST: Zia?

MR. YUSUF: So, I'd say kind of radical, public, private collaboration. So much of our economy here and elsewhere is embedded in the public sector from a GDP perspective and health care and so on and so forth. I mean, I'm partially an Obamacare supporter. Won't get into that discussion, but I think it was just -- it just blew me away that 600 million was spent on a website even with the back end stuff, right? I mean, I just -- I don't get it.

And so I think bringing the public and private sector together not in the traditional way that it has been done but looking at different frameworks where that

collaboration can happen in a much less risky way would have pretty dramatic impact.

MR. WEST: Well, I have learned several things on this panel. I've learned about liberation technology, smart loans, and, my favorite, smart garbage cans. (Laughter) So I guess that is in our future.

I want to thank Steven, Zia, and Kenfield for sharing your expertise with us. Thank you very much.

MR. GRIFFITH: Thank you.

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I, Carleton J. Anderson, III do hereby certify that the forgoing electronic file when originally transmitted was reduced to text at my direction; that said transcript is a true record of the proceedings therein referenced; that I am neither counsel for, related to, nor employed by any of the parties to the action in which these proceedings were taken; and, furthermore, that I am neither a relative or employee of any attorney or counsel employed by the parties hereto, nor financially or otherwise interested in the outcome of this action.

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